NASA's Mission Operations and Communications Services

This Description applies only to proposals in response to NASA's Announcement of Opportunity for Small Explorers (SMEX) and Missions of Opportunity

AO 99-OSS-05

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1.0 INTRODUCTION

This document is intended to assist in the preparation of proposals in response to an Announcement of Opportunity (AO) issued by NASA's Office of Space Science (OSS) for Small Explorers (SMEX) and Missions of Opportunity. NASA provides many operations and communications services that are available for NASA missions. The use of these services will incur costs to the user and estimates for these costs need to be included in proposals submitted under this AO. To facilitate proposal preparation, proposers are to read this appendix and contact the individuals named in Section 1.6 below.

1.1 Costing Policy

As a matter of policy, NASA will include estimated costs for mission operations and communications services, as well as an assessment of key parameters for mission operations, in the evaluation and selection processes for all Earth-orbiting and deep space missions. The OSS and the Space Operations Management Office (SOMO), are implementing this policy:

- in anticipation of formal NASA-wide full-cost accounting,
- to better manage our currently oversubscribed communications resources,
- to encourage tradeoffs between on-board processing and storage vs. communications requirements, and
- to encourage proposers to design hardware and operations systems which minimize life cycle costs while accomplishing the highest-priority science objectives.

1.2 Choice of Service Providers

Proposers are free to use all, some, or none of the NASA-provided services described below. Regardless of this choice, the proposal must include a rationale for the level of communications services proposed, the basis for costs of communications services, key communications parameters listed below, and a rationale and cost basis for mission operations services. Required services should be identified irrespective of the provider. As a matter of policy, proposers should be prepared during the definition phase to support tradeoff studies with the OSS and SOMO on the use of NASA-provided services versus proposed alternatives. Contact with SOMO is encouraged early in the proposal development process to help the converge on the best approach.

1.3 SOMO Services

NASA has consolidated management of space mission operations, space-ground communications, and ground wide area networks under SOMO at the Johnson Space Center. Consolidation of these systems, including the Deep Space Network (DSN), the NASA Ground Network (GN), the Tracking and Data Relay Satellite System (TDRSS), the NASA

Information Services Network (NISN), and mission operations systems, was performed to enable migration to a common architecture across the agency, eliminate redundancy, and share resources. The ultimate objective is to reduce the cost of operations and increase funding available for science. Most space operations services are provided through a <u>Consolidated Space Operations Contract (CSOC)</u>, with some selected services (e.g., international DSN sites) managed by NASA Centers.

SOMO has moved from a facilities-based support approach to one based upon standard services defined in terms of "units of service" and "cost per unit". A *SOMO Services Catalog* defining these service is near completion and will be available to support SMEX proposal preparation. Table 1 summarizes SOMO service categories.

SOMO Service Category Brief Description Command RF modulation, transmission, and delivery of telecommands to spacecraft. Telemetry data capture and additional value-added data routing and processing. Telemetry Telecom Analysis Spacecraft link performance, analysis, and prediction. Mission Planning Trajectory and mission design, launch analysis, science instrument planning. Sequence Engineering Uplink process and sequence design, S/C operations schedule, event prediction. Mission Control Monitors spacecraft health and safety and sends corrective commands. Monitors specific spacecraft instruments, sends corrective commands. Instrument Control Mission Data Management Data buffering, staging, storing, and archiving. Tracking and Navigation Radio metric data capture and generation of high order navigation products. Flight Engineering Performance analysis and anomaly detection of instrument and S/C systems. S/C Time Correlation Monitors spacecraft clock drift and correlates time to a standard time reference. **Experiment Data Products** Higher level processing (e.g., image and data visualization products) Radio Science S/C Doppler, range, and open-loop receiver measurements at 2, 8, and 32 GHz. VLBI Capture of narrowband or wideband very long baseline interferometric data. Similar to Radio Science except measures natural phenomena. Radio Astronomy **Ground Communications** Data, voice, and video communications network services. Planning, scheduling controlling, configuring and accounting of system resources. Service Management

Table 1: SOMO Service Categories

1.4 Process for Requesting Services

Proposers should contact SOMO for information on NASA's mission operations services and costs at the time when initial science operations concepts are being defined. A SOMO representative will provide information on SOMO services and costs, and will assist in documenting initial mission operations requirements in a format termed a "Service Request". During the study phase, as the proposer's mission concept becomes more clearly defined, the requirements in the Service Request will be clarified, and the resulting documentation of services and costs agreed to by the proposer will become a "Project Service Level Agreement (PSLA)" to be signed by a SOMO representative and the proposer. The PSLA will identify all mission operations requirements, even those provided by non-SOMO sources, to provide a

source of end-to-end operations information and to document any cost analyses leading to the selection of non-SOMO services.

1.5 Standards

It is NASA policy that space missions receiving funding from NASA comply with all international and United States regulations, standards, and agreements. Such regulations and standards include those promulgated by:

International Telecommunications Union (ITU)
National Telecommunications and Information Agency (NTIA)
Consultative Committee for Space Data Systems (CCSDS)
Space Frequency Coordination Group (SFCG)

Information about the ITU and NTIA regulations can be obtained from the NASA Management Office at the Glenn Research Center or by consulting References 1 and 2. Recommended standards applicable to DSN, Ground Network, or TDRSS support can be obtained from Reference 3, the CCSDS home page.

1.6 SOMO Contact Information

The primary SOMO point of contact for this AO is the SOMO Lead Center Mission Services Manager (CMSM) for the Small Explorers missions:

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GSFC Center Mission Services Manager

Code 450

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Greenbelt MD 20771

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For information about NASA's overall mission operations and communications service plans, contact:

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Any further questions concerning mission operations functions or services should be directed to the technical points-of-contact listed in paragraph 6.1.2 of this AO.



4.0 REFERENCE DOCUMENTS

Prospective users of SOMO facilities can obtain additional information from the following documents:

- 1. *Radio Regulations*, International Telecommunications Union, Geneva, Switzerland, Latest Edition
- 2. Manual of Regulations and Procedures for Federal Radio Frequency Management, National Telecommunications & Information Administration, U.S. Department of Commerce, Washington D.C., Latest Edition. Information is available at: http://www.ntia.doc.gov/osmhome/redbook/redbook.html
- 3. Consultative Committee for Space Data Systems (CCSDS). Blue Books published by the CCSDS Secretariat, NASA Headquarters, Washington D. C. 20546. *Copies of CCSDS Recommendations are available at: http://www.ccsds.org/blue_books.html*
- 4. Space Operations Management Office, Services Catalog, prepared by CSOC, Contract NAS 9-98-100, DRD 2.3a, December 31, 1998 UNDER Development. See contacts referenced in para 1.6 above for more information.
- 5. AMMOS and DSN Support of Earth Orbiting and Deep Space Missions, Document D-13973, Telecommunications and Mission Operations Directorate, Jet Propulsion Laboratory, Pasadena, California. *See information at*

http://deepspace1.jpl.nasa.gov/advmiss

6. Handbook of the Space Frequency Coordination Group, SFCG Secretariat, Frequency Management Office, European Space Agency, 8-10 Rue Mario Nikis, 75738 Paris, France, Latest Update. Recommendations and Resolutions can be obtained at: http://www.space-frequency.org